# Investigation on the roughness measurement of the lathe turned surface by the Fraunhofer diffraction of a slit aperture.

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This thesis proposes a new measurement technique for the surface profile with the zeroth central intensity of the Fraunhofer diffraction pattern of a slit aperture and describes its application to monitoring the roughness of the lathe turned surface. The slit aperture consists a knife edge and a turned cylinder surface. For the roughness measurement using the He-Ne laser beam, the relationship between the slit width and the beam radius is investigated. The effect of the reflection light is theoretically calculated under several reflection conditions. The intensity distribution is influenced by the light reflected at the cylinder surface. The experiment to verify the theoretical result is carried out. It is revealed that the diffraction pattern depends upon the surface feature around narrow slit width.

In addition, the measurement of the roughness of the turned surface are carried out by three methods as follows: 1) The profile measurement based on the zeroth central intensity. 2) The measurement by the edge vibration method with a piezoelectric actuator. 3) The measurement of root-mean-square roughness (RMS). It is depicted that the experimental results are agree well to that of the conventional stylus instrument (Talysurf-4).

In conclusion, the measurement conditions to measure the surface roughness and the effect of the reflected light caused on the cylinder surface are analyzed. It is shown that this measurement technique with the zeroth diffraction pattern by a slit aperture can be applied to the measurement of the roughness of the lathe turned surface.